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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/560,690

12/13/2005

Michael C. Gaidis

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INTERNATIONAL BUSINESS MACHINES CORPORATION

DEPT. 18G

BLDG. 300-482

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HOPEWELL JUNCTION, NY 12533

EXAMINER

GOODWIN, DAVID J

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 10/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/560,690

Applicant(s)

GAIDIS, MICHAEL C.

Examiner

David Goodwin

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 December 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 12/13/05.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Objections

1. Claim 13 is objected to because of the following informalities: The claim recites the limitation "the formation of said via." There is insufficient antecedent basis for this limitation. Appropriate correction is required.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. Claims 1, 2, and 3 are rejected under 35 U.S.C. 102(e) as being anticipated by Anma (US 6,599,809).
2. Regarding claim 1.
3. Anma teaches a method of an alignment mark structure for a semiconductor device. Said method comprises forming an alignment recess (2) at a selected level of the semiconductor substrate (1) (fig 4) (column 9 lines 30-40). A first metal layer (4) is formed over the selected substrate level and within the alignment recess (2). Said

Art Unit: 2818

alignment recess (2) is formed at a depth such that said first metal layer (4) only partially fill said alignment recess (2) (column 9 lines 30-45). A second metal layer (5) is formed over the first metal layer (4) and the alignment mark is completely filled (fig 4) (column 9 lines 35-45). Planarizing the second metal layer (5) and the first metal layer (4) to said selected substrate (1) level, creating a sacrificial plug of second layer material within the alignment recess (2) (fig 5) (column 9 lines 40-60). The sacrificial plug is removed in a manner so as not to substantially roughen the planarized surface at the selected substrate level (fig 6) (column 9 lines 60-65).

4. Regarding claim 2.

5. The second metal has an etch selectivity with respect to the first metal (column 9 lines 30-50).

6. Regarding claim 3.

7. Said second metal layer (5) has an etch selectivity with respect to a dielectric (1) material surrounding said alignment recess (2) (column 9 lines 30-55).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 2818

9. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anma (US 6,599,809) as applied to claim 2 above, and further in view of Chiang (US 6,413,383).

10. Regarding claim 4

11. Anma teaches elements of the claimed invention above.

12. Anma does not teach the deposition of tantalum and copper.

13. Chiang teaches the deposition of a first tantalum nitride diffusion barrier layer, with a tantalum adhesion layer deposited thereon and copper deposited thereon (column 5 lines 35-50).

14. It would have been obvious to one of ordinary skill in the art to fill the trenches with tantalum and copper in order to increase conductivity and inhibit diffusion contamination.

15. Regarding claim 5.

16. Chiang teaches the deposition of a first tantalum nitride diffusion barrier layer, with a tantalum adhesion layer deposited thereon and copper deposited thereon (column 5 lines 35-50).

17. It would have been obvious to one of ordinary skill in the art to fill the trenches with tantalum and copper in order to increase conductivity and inhibit diffusion contamination.

18.

Art Unit: 2818

19. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Anma (US 6,599,809) as applied to claim 2 above, and further in view of Agarwala (US 6,972,209).

20. Regarding claim 6

21. Anma teaches elements of the claimed invention above.

22. Anma does not teach the method of depositing metal layers.

23. Agarwala teaches that metal layers for a via may be deposited by CVD or PVD (column 6 lines 50-65).

24. It would have been obvious to one of ordinary skill in the art to deposit the metal layers by CVD or PVD in order to obtain a highly uniform layer over the surface of the substrate.

25. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Anma (US 6,599,809) as applied to claim 2 above, and further in view of Okada (US 3,887,993).

26. Regarding claim 7

27. Anma teaches elements of the claimed invention above.

28. Anma does not teach the composition of the wet etch.

29. Okada teaches the use of dilute phosphoric acid to etch a tungsten layer (column 5 lines 10-25).

30. It would have been obvious to one of ordinary skill in the art to use dilute phosphoric acid because these materials and processes are frequently used in miniaturized device fabrication so the properties, techniques, and materials required for

their use in processing are well understood, predictable, reliable, and available. This common use and well known understanding of the material and process will result in a high production efficiency and lower failure rates.

31. Claims 9, 10, 11, 12, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anna (US 6,599,809) as applied to claim 2 above, and further in view of applicants admitted prior art (figs 1- 3d).

32. Regarding claim 9

33. Anna teaches elements of the claimed invention above.

34. Anna does not teach the alignment mark is used with an MRAM.

35. Applicant's admitted prior art teaches an MRAM having a via and an alignment mark (fig 3).

36. It would have been obvious to one of ordinary skill in the art to use an alignment mark to align the elements of the MRAM device so that the elements of the device will line up correctly thereby forming a high quality connection.

37. Regarding claim 10.

38. Applicant's admitted prior art teaches an MRAM having a via, wherein said alignment recess is formed at a greater depth than a depth of a via used to connect a metal strap of the MRAM device to a lower metallization level line of the MRAM device and an alignment mark (fig 3a).

39. It would have been obvious to one of ordinary skill in the art to make the alignment mark deeper than the via used to contact the underlying metal so that the mark will be visible after the deposition process.

40. Regarding claim 11.

41. Applicant's admitted prior art teaches an MRAM having a via, wherein the level is at a level used to define a metal strap. The material used to define said metal strap is opaque (page 5 lines 1-20).

42. It would have been obvious to one of ordinary skill in the art to form an alignment mark at a level of a metal strap in order that the strap, MRAM device, and underlying vias, and metalizations can be properly lined up.

43. Regarding claim 12.

44. Applicant's admitted prior art teaches the alignment recess (130) is formed simultaneously with the via and is fully formed by an overetch (fig 3a) (page 5 lines 15-30).

45. It would have been obvious to one of ordinary skill in the art to define the recess and the via at the same time to reduce the number of process steps.

46. Regarding claim 13.

47. Applicant's admitted prior art teaches the alignment recess (130) is defined subsequent to the formation of the via (fig 3a) (page 6 lines 5-20).

48. It would have been obvious to one of ordinary skill in the art to define the via after the formation of the via to reduce the possibility of contamination of the via.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Goodwin whose telephone number is (571)272-

8451. The examiner can normally be reached on Monday through Friday, 9:00am through 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571)272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DJG

Andy Nguyen
Primary Examiner